

# **VIBRATION INSTRUMENT CALIBRATION METHOD AND APPARATUS**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

This invention relates to calibrating instruments and, more particularly, to a method and apparatus for on-site calibration of a machine condition monitoring vibration measuring instrument (MCM instrument).

### **2. Background Art**

Owners of MCM instrument conventionally return equipment back to the original equipment manufacturer's (OEM) lab or to a third party calibration lab by one of the many conventional shipping companies (e.g. UPS, FedEx, etc.) to be calibrated to NIST (National Institute of Standards and Technology) standards. This method entails shipping expense, possible shipping damage of the equipment, shipping delays, and backlog delays at the lab, as well as requiring the handling and packaging of the equipment for shipment at both ends. This conventional method is shown in Fig. 11, where experience indicates a 2 – 5 day delay in shipping at both ends, dependent on distance and type of shipping method used (i.e. ground, next-day air, etc.), plus a backlog delay at the testing lab of 5 – 14 days.

After receipt of this MCM instrument, the lab performs the calibration using such testing equipment as a Digital Voltmeter (DVM), Signal Generator, Frequency Counter and a shaker table for checking vibration transducers or vibration pickups. This test equipment is very large, not mobile and very expensive. The labs use calibration procedures, which include (a) written instructions on how to connect test cables between the MCM instrument being calibrated and test equipment, and how to connect test cables between the MCM instrument and test equipment; and (b) procedures of data collection of the MCM instrument.

Different calibration methods are used for different makes and models of instrumentation. Data Collection is taken by comparing various amplitude and frequency standards with test equipment readings from the MCM Instrument being calibrated. Amplitude and frequency readings from the MCM instrument is manually written down into a form. If the reading from the MCM instrument is within the Standards, a Calibration Certificate is provided to the owner of the MCM instrument.

After completion of the calibration procedure, the lab returns MCM instrument to the owner by the same shipping method as previous, entailing additional shipping

expense, potential shipping damage to the equipment, and added delay, as shown in Fig. 11.

The turnaround time required for this method of calibration the MCM instrument is on the order of 9 - 24 days total, during which time period, the MCM instrument is unavailable for usage.

It would be desirable to provide a method for calibrating MCM instruments that reduce the time required for calibration, and reduce shipping expense and equipment damage.

#### SUMMARY OF THE INVENTION

It is an object of this invention to provide a method for calibrating MCM instruments that reduces the time required for calibration, and reduce shipping expense and equipment damage.

In its broadest aspect, this invention provides a method for calibrating vibration measuring equipment that eliminates turn-around time, eliminates shipping damage, and eliminates shipping costs.

In one aspect, this invention features apparatus and a method of enabling on-site calibration of an instrument that measures vibration in a machine to assure that the instrument functions within instrument performance standards, comprising providing a calibration device capable of calibrating the instrument, providing a database having a calibration procedure for said instrument, connecting the calibration device to the instrument while the instrument is on-site, connecting the calibration device to the database, and accessing the calibration procedure in the database to cause the calibration device to calibrate the instrument.

In another aspect, this invention features providing the database on portable storage media, and providing an on-site media access device for enabling the calibration device to access the database on the portable storage media.

In a further aspect, this invention features providing the database at an internet accessible remote site, and providing on-site internet access for connection to the database at the internet-accessible remote site.

These and further objects and features of this invention will become more readily apparent from reading the following detailed description, with reference to the accompanying drawings, in which:

## DESCRIPTION OF THE DRAWINGS

Figs. 1 – 10 are sequential depictions of MCM instrument calibration according to this invention; and

Fig. 11 is a schematic representation of a prior art method of calibrating a vibration measuring instrument

## DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In accordance with this invention, the owner of machine condition monitoring vibration measuring instrument (MCM instrument) which needs calibration is provided with a calibration 'kit', traceable to NIST. This kit contains the same type of instrumentation used by calibration labs to calibrate MCM instruments shipped to them. Also provided is a calibration procedure on portable storage media, such as a floppy or a CD-ROM, or identification for connectivity to website for connection to a computer having the calibration procedure. The procedure is designed for the MCM specified by the owner. Calibration procedures are available for IRD, Entek-IRD, CSI, SKF and many other OEM's instrumentation. This allows the owner to calibrate vibration data collectors, dedicated vibration analyzers, permanently installed vibration monitoring systems (except non contact pick-ups), and balancing machine instrumentation, and to check instrument transducers with equipment as a system on-site at the owner's place of business.

To obtain access to purchase the instrument specific certification procedures, the equipment owner accesses the provider's internet site and inputs the following information:

Owner's name and address to establish equipment database and provide a customer number,

OEM instrument make and model number,

MCM serial number,

Operational tolerances established by owner if other than to OEM product specifications (to ensure procedures provided and resulting test results are in compliance with ISO/Company Quality Assurance program requirements.

List any transducers used in conjunction with the equipment, and

Choice of CD-ROM or web access to perform the calibration procedure.

After digesting the above information, the calibration certification procedure provider either sends the CD, or provides UserID and password for access to the website computer database, containing the procedure for the specified MCM instrument to the owner. The MCM instrument owner then follows the procedure set forth below and the calibration certification can be completed within 45 minutes or less. This compares to the usual 9 – 24 days required by using the conventional process of shipping the instrument to the lab for calibration.

Detailed Calibration Procedure:

1. Download the calibration procedure(s) program from provider's website or from the CD onto a laptop computer.
2. Go to "procedure selection" on the program and select the procedure needed for calibration of the specific MCM equipment to be calibrated. See Fig. 1.
3. Read the test information and click "Advance". See Fig. 2. A picture of the calibration equipment will appear. See Fig. 3.
4. Read the test information and click "Advance". A picture of the equipment setup and cable connections will appear, along with procedures and setup information, prompts and questions. See Fig. 4. Click "Advance".
5. The program will then provide prompts to perform the calibration procedures and a number of equipment performance questions, the answers to which are stored in the database. Proceed until completion of the test procedure.
6. If unit under calibration successfully completes test procedure, the program will display a "Calibration Results" screen, stating that the instrument has "passed". See Fig. 5. However, if the instrument unsuccessfully completes the test procedure, the program will display a similar "Calibration Results" screen, stating the instrument has "failed". See Fig. 6. These draft results can then be printed, as can draft "Certificate of Calibration" or a "Failed Calibration Report". See Figs. 7 and 8.
6. A final validated "Calibration Results" and "Certificate of Calibration", along with a calibration sticker reflecting calibration date and calibration due date, can then be obtained by e-mailing or faxing a copy of the "Draft Calibration Results" and "Certificate of Calibration" to the vendor, where these documents will be reviewed by a qualified technician and given to a quality manager for validation. Thereafter, the final calibration Results and Certificates of calibration, traceable to the NIST standards, and a calibration sticker, as illustrated in Figs. 9 and 10, will be provided to the instrument owner.

By using this procedure of calibrating a MCM instrument on-site, the instrument owner gains these advantages over using the conventional "ship-back-to-test-lab" procedure:

- no more turnaround time
- no lost revenue because instrument not available for use
- no more lost or damaged instruments
- no instrument shipping expense
- no more OEM maintenance agreement cost for calibration

Even with all these advantages, the owner is still in compliance with quality standards and traceable to NIST.

Although only one preferred embodiment of this invention has been disclosed and described, obvious modifications will become readily apparent from reading this disclosure and are intended to be covered by the appended claims.